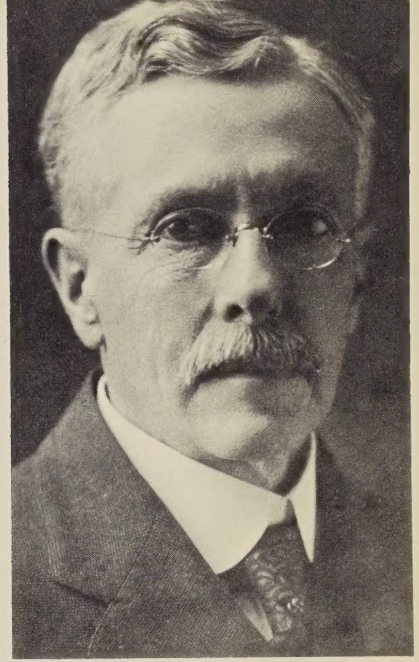
INCREASING LIVESTOCK EFFICIENCY

Through Research

DR. H. P. ARMSBY



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The U.S. Department of Agriculture's first venture in animal husbandry research began in 1898 with the employment of Dr. H. P. Armsby to conduct animal nutrition studies. Today scientists of the Department's Animal Husbandry Research Division also study animal genetics, physiology, and other fields of animal science. The Division utilizes more than 130 scientific man years each year in studies at the Agricultural Research Center, Beltsville, Md.; at Federal field stations; and at cooperating State experiment stations. This publication shows the scope and value of the research—its contribution to the more than 90 percent increase in livestock efficiency in the past 50 years, and to basic knowledge needed for steady progress in the future.

BREEDING

Sewell Wright pioneered USDA's basic genetics work with his classic studies of guinea pigs. Today this type of research continues in two basic research laboratories in animal genetics and immunogenetics. Findings from early growth-rate studies of beef cattle have led to the use of record-of-performance testing throughout the Nation. Beef cattle geneticists now are evaluating several breeding systems and studying the inheritance of many economic traits. More and heavier lambs have resulted from studies showing the value of breeding open-faced sheep. Research has shown that all classes of livestock can be improved by selecting stock with certain desirable traits for breeding.

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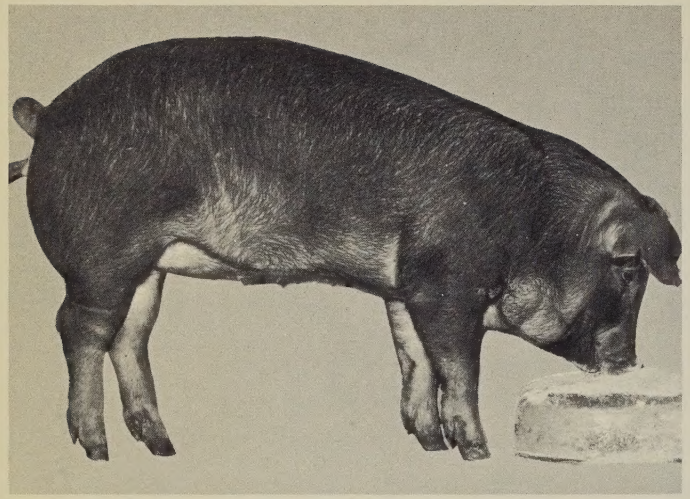

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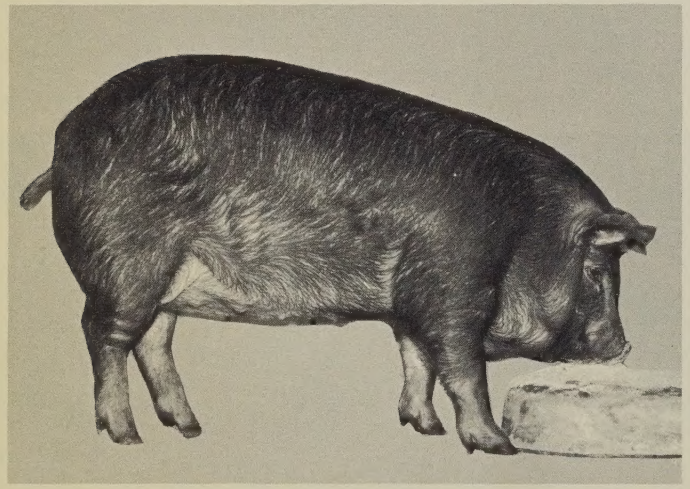

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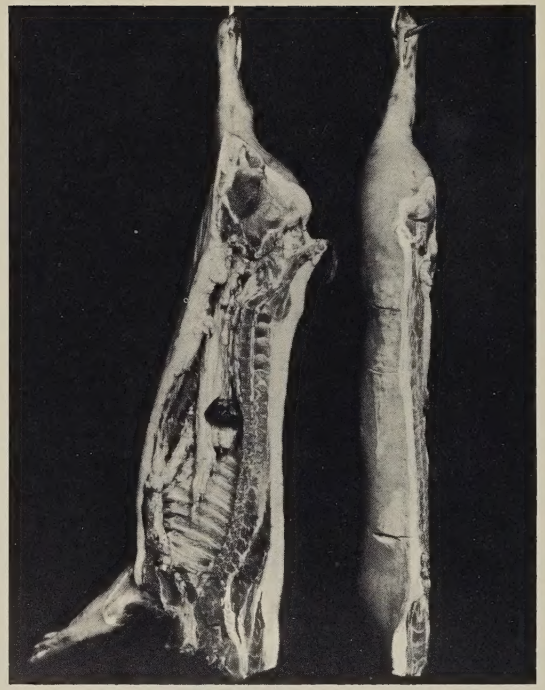

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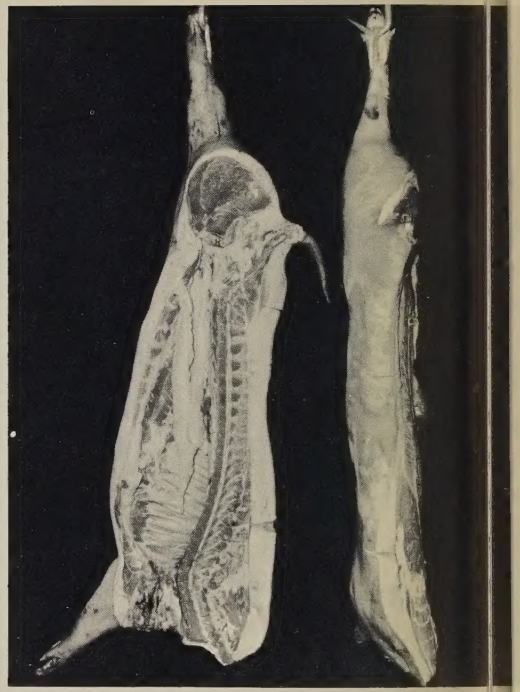

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Today's popular meat-type hog stems from an early USDA breeding study of large, intermediate, and small swine. The Regional Swine Breeding Laboratory, run cooperatively with ten States, has studied the use of inbreeding and inbred lines for improving swine. The use of genetically evaluated dairy bulls in breeding to increase milk production was begun 40 years ago. It has led to the development of the Beltsville herd, one of the country's highest-yielding dairy herds. Much of the emphasis on progeny-tested bulls for artificial breeding resulted from this study. Progress in developing superior broiler stocks, improving egg production, and increasing feed efficiency has resulted from poultry breeding research. Scientists are currently working to develop new breeding methods to insure continued poultry improvement.

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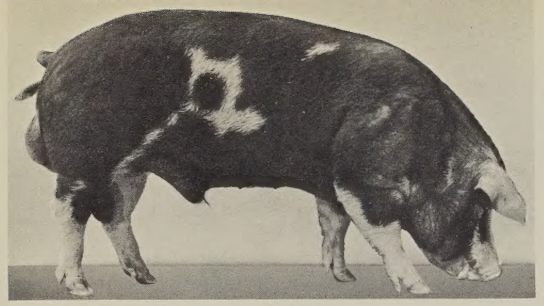

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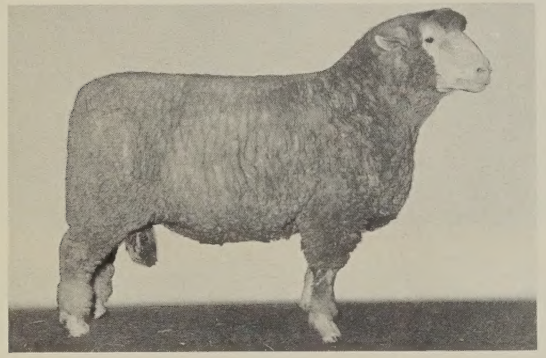

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USDA pioneered the use of imported animals for breeding studies. Red Danish cattle were imported to determine their value and crossbreeding ability. Cattle from India helped scientists learn how animals adapt to hot, humid climates. USDA also helped bring in Corriedale sheep, Landrace hogs, and Afrikander cattle. The formation of new breeds has been a major accomplishment. These include: Beltsville and Montana hog strains and others cooperatively developed; the Beltsville Small White turkey, and Columbia and Targhee sheep. Current studies involve the development of Columbia-Southdale sheep and a dairy strain from crossbreds. The results of such research have led producers of swine, sheep, and beef cattle to use crossbreeding for livestock improvement. Scientists are also evaluating dairy cattle crossbreeding.

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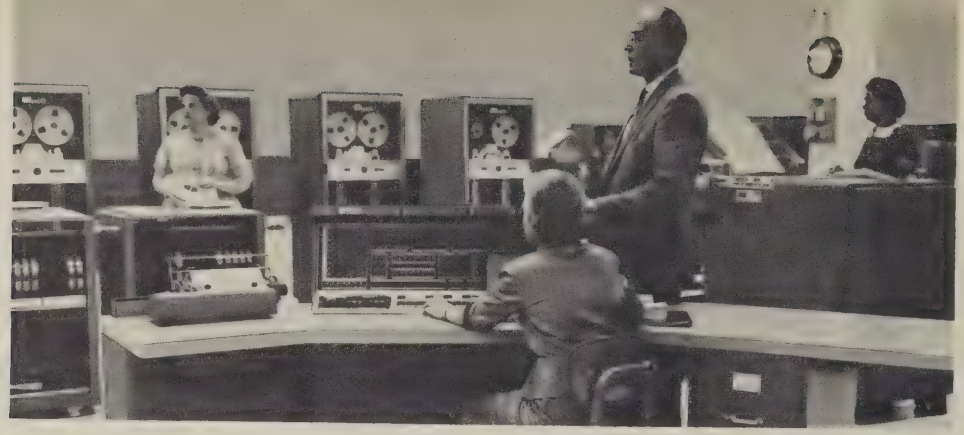

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Record of performance studies and demonstrations are important segments of USDA's animal husbandry work. Homer Ribald started the Dairy Herd Improvement Program in 1905. Today, USDA keeps DHIA production records on 3,000,000 cows in 67,000 herds. The National Cooperative Sire and Cow Evaluation Program began in 1935. Now nearly 2 million records a year are handled with electronic data processing equipment to evaluate sires and cows and to carry out population genetics research. Analysis and publication of random sample testing results are important poultry improvement functions of USDA. Producers and breeders use this information to evaluate production factors of various commercial poultry stocks.

N–40565

Beef cattle performance testing is gaining acceptance as an on-the-farm practice. Research has proved the value of cattle selection based on recorded data, and cattlemen are responding. In 1960, more than 304,000 cows in 4,000 herds were enrolled in extension programs—almost twice those enrolled in 1957. Beltsville scientists were among the first to use record-of-performance methods to test swine for efficiency and rate of gain. Several States now have on-the-farm swine ROP testing. There is growing interest in the use of central testing stations for comparing litters. Sheep ROP testing has been aided by studies of the inheritance of economic traits. Many commercial sheep growers now use records of these traits. Some States have testing stations or on-the-farm plans for small sheep flock owners.

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PHYSIOLOGY

USDA scientists studying reproduction physiology were first to recover an unfertilized ovum (egg) from a cow. Current work stresses the hormonal mechanisms related to reproduction and milk secretion. Scientists are studying turkey parthenogenesis—the production of living birds from unfertilized eggs. The fatherless turkeys obtained are being used in skin grafting research in cooperation with workers in human medicine. Poultry scientists also are studying the function of a hen's nervous system in controlling egg laying. Recent anatomy studies resulted in the world's only textbook on blood systems of poultry. Studies are underway to find how to make ewes breed and lamb the year around, and so extend the restricted breeding season of sheep. This could mean big gains in lamb production. Scientists are also studying the physiology of wool fibers.

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A detailed study of cattle anatomy was conducted in the 1920's. Reconstruction of dairy and beef cow skeletons showed few differences between them. Then came studies of cow's udders and measurements of body form as ways to predict meat and milk yields. Recent research has shown limitations in using dairy type to improve milk yields or productive life. Increased livestock production in the South led to studies of how cattle withstand heat. Research by USDA and cooperating States has shown that heat tolerance is affected by the animal's rate of heat production while eating, growing, or producing milk. The best gauges of heat stress were found to be the amounts of air inhaled and exhaled in a single breath, and body temperatures. Environmental studies of sheep, poultry, and swine are also underway.

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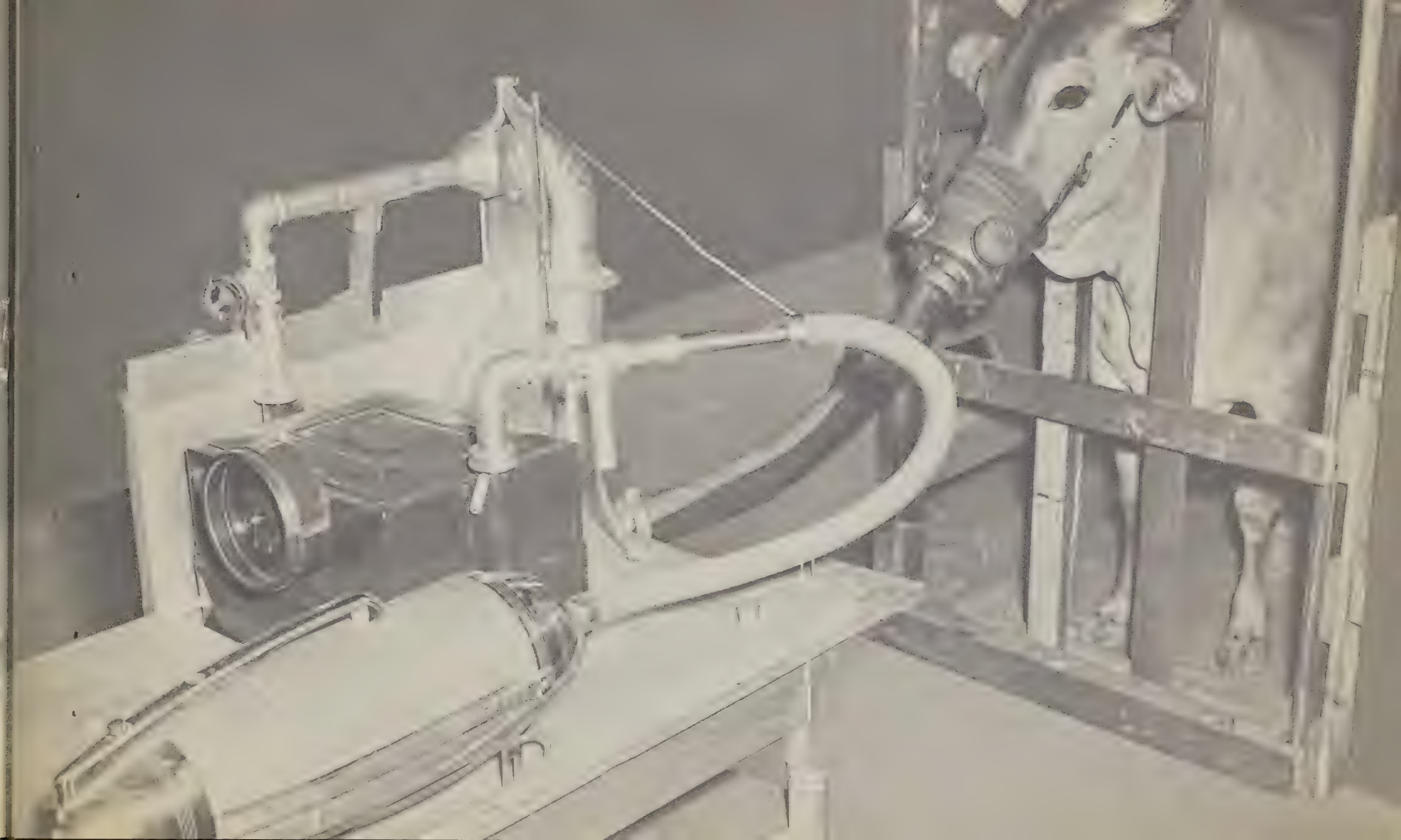

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NUTRITION

Early and continuing studies of livestock vitamin and mineral needs have formed the basis of balanced, efficient rations. Basic studies of rats and poultry led to the identity of and need for vitamin B_{12} by both livestock and humans. Vitamin A needs were determined for cattle. Thiamin, riboflavin, and pantothenic acid requirements of pigs were established. Scientists ascertained the zinc needs of hogs and the value of phosphorus for dairy and beef cattle. Four nutritional disorders are being studied—bloat, grass tetany, urinary calculi (water belly), and gossypol poisoning. Scientists are also learning about the digestion, fermentation, and microbial activiities that go on inside a cow's rumen.

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USDA researchers are studying the fat and energy-conversion requirements of poultry. They have investigated the limitations of plant proteins in poultry diets. Their basic studies have revealed that fats in the feed promote growth. They have learned how arsenicals stimulate broiler growth. Department scientists pioneered the development of nutritional standards for mink, and helped devise practical, balanced rations for rabbit, marten, and fox.

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The best ways to produce, harvest, and preserve forage to insure its efficient use by livestock are being studied. Scientists have shown the value of Coastal bermudagrass for grazing by beef cattle in the South. They also have demonstrated the value of feed supplements to beef cattle on winter ranges. Investigations now include making and feeding grass silage to cattle and sheep. A recent USDA study shows that dairy cows do better on low-moisture silage than on high-moisture silage.

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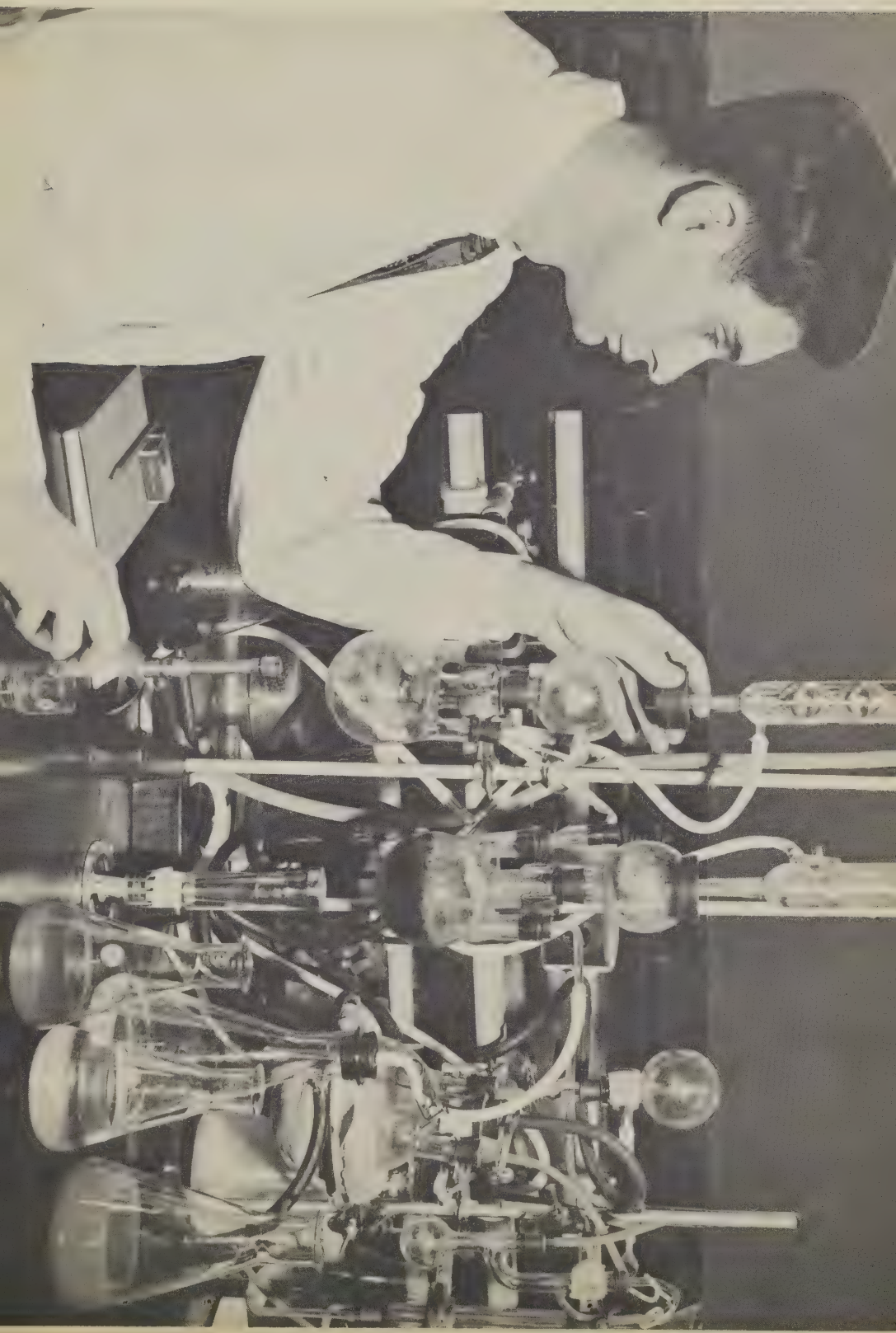
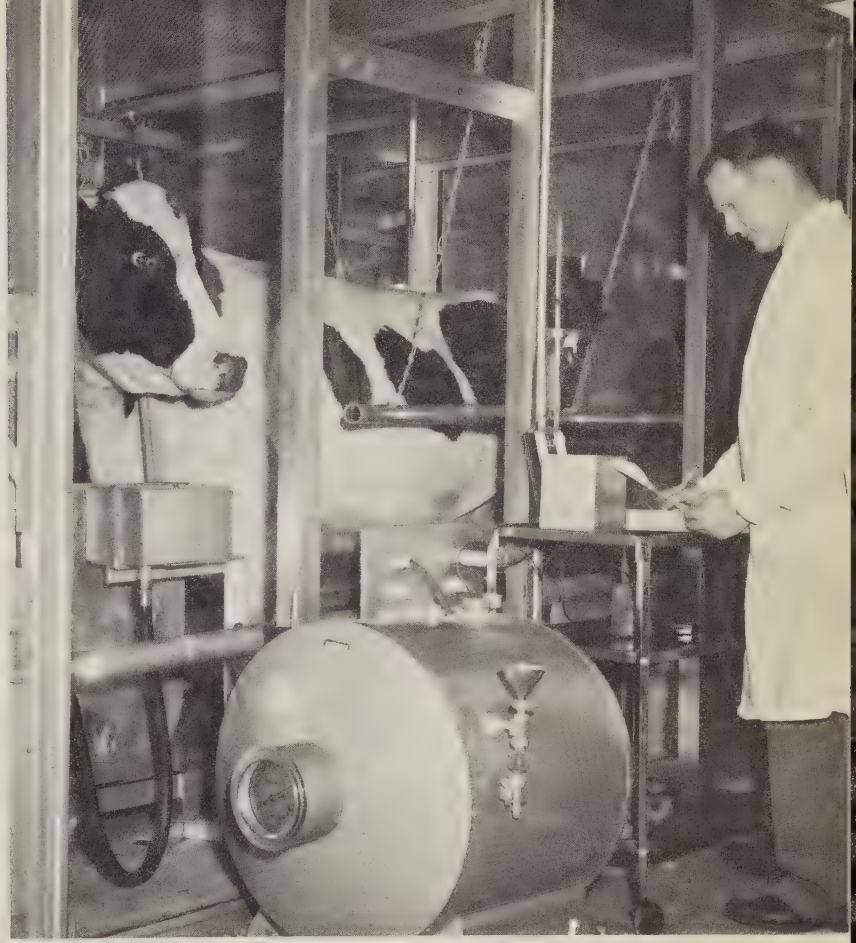


An important part of USDA nutrition work is determining the requirements of animals and the value of feeds they eat. This kind of research dates back to 1898, when it was begun by Dr. Armsby. It continues today, and Department scientists have led in developing new and improved concepts of feeding livestock. They operate, at Beltsville, the world's most extensive energy metabolism laboratory. Highly automated facilities at this laboratory have made it possibe to conduct more energy-balance trials in a single year than were conducted throughout the world prior to 1960. Through work at the laboratory, scientists have established the nutritional requirements and nutritional efficiency of high milk-producing cows, as well as net energy concepts for feed evaluation. A new chemical method of forage evaluation developed at the laboratory represents a major breakthrough, the first of its type in 70 years.



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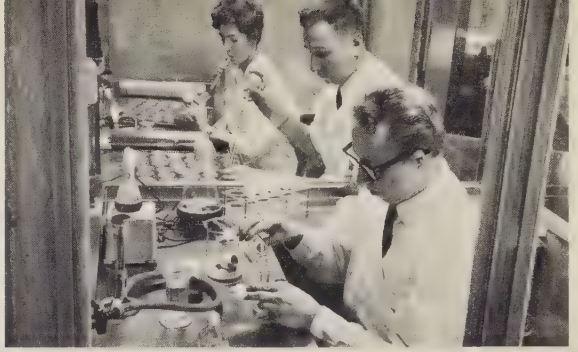
AVIAN LEUKOSIS

A laboratory to study ways to combat avian leukosis (range paralysis) of chickens was opened in 1939. Its scientists learned that leukosis is caused by virus organisms. Workers now are studying the use of vaccines to control leukosis and are developing diagnostic tests and ways to grow the viruses. Leukosis was found to be a disease similar to cancer in humans, and strains of chickens developed at the laboratory are used by medical scientists in cancer research. USDA scientists have found that some chickens inherit susceptibility to various types of leukosis. Recent research has demonstrated that at least two entirely different viruses cause leukosis. One virus causes acute leukosis (Marek's disease); the other causes lymphoid leukosis.



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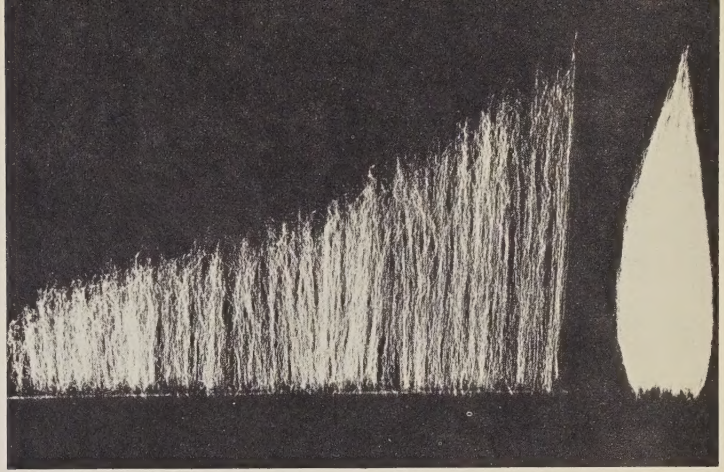
PRODUCT IMPROVEMENT

Tasty, nutritious food is an inherent goal of all animal husbandry research. Early studies showed the effects of feed and management on milk flavors, and established the practices necessary to produce good milk. The Watson Lactometer for analyzing solids-not-fat in milk was developed by USDA scientists. Studies have recently been made on the usefulness of protein analyses of milk from individual cows. UDSA wool scientists have developed ways to evaluate wool fineness, fiber length, crimp, color, yield, and strength. Similar progress is being made with mohair and fur animal fibers. Egg studies have resulted in ways to measure albumen quality and detect blood spots. Current studies include the effects of genetics, nutrition, and manegement on the quality of poultry meat and eggs.



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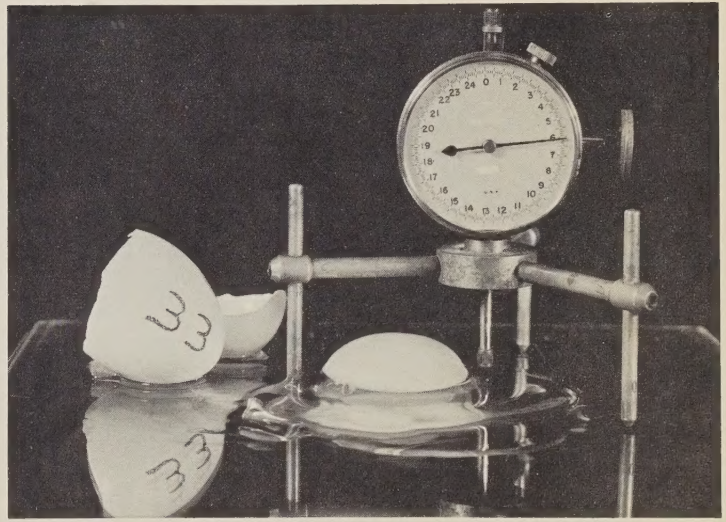

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Early swine research showed how feeds affect the softness of pork fat. Studies of rabbits showed that meat tenderness is inherited. This led to extensive livestock tenderness research. Meat tenderness is now gauged by devices such as the hydraulic pressure and the Warner-Bratzler shear tests, developed by the USDA. Scientists use leanmeters to estimate the live hog's backfat thickness, and ultrasonic devices to predict carcass traits in beef, swine, and sheep. They are learning how animal breeding, feeding, and management affect chemical, histochemical, nutritional, and palatability properties of meat.

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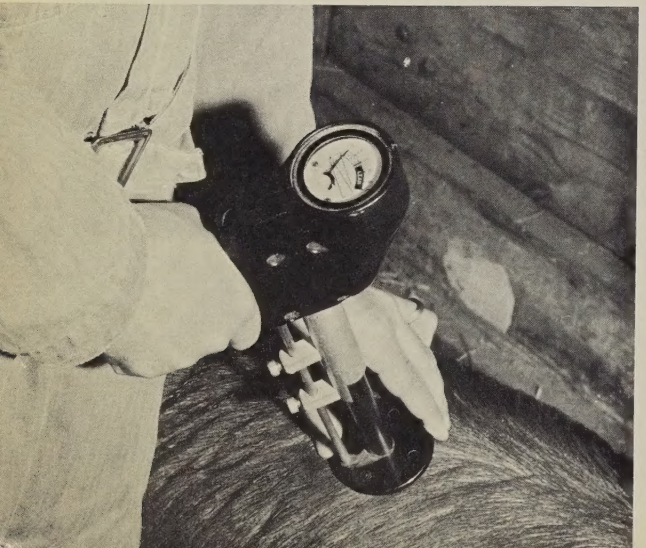

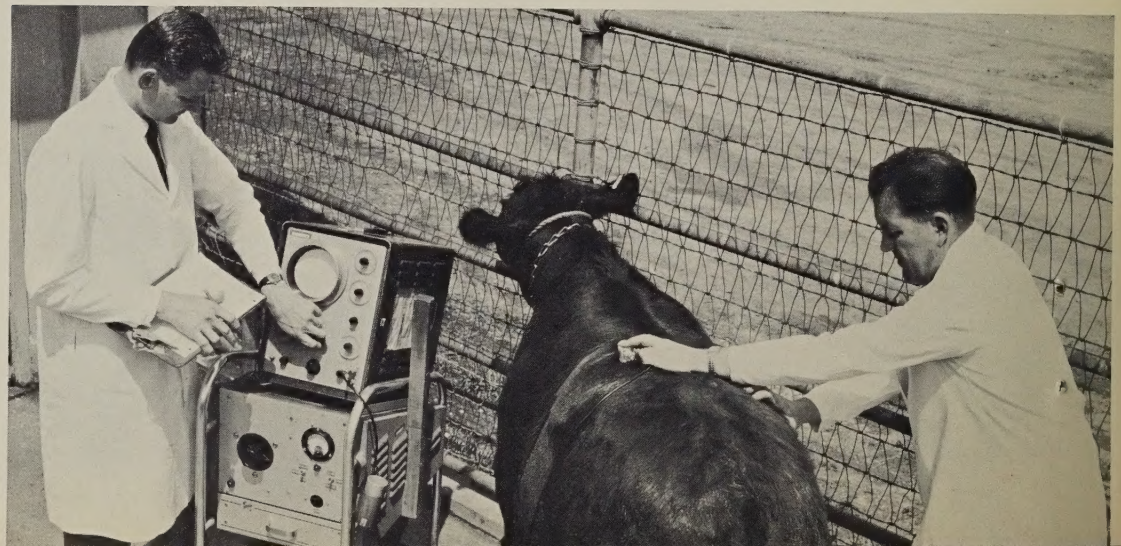

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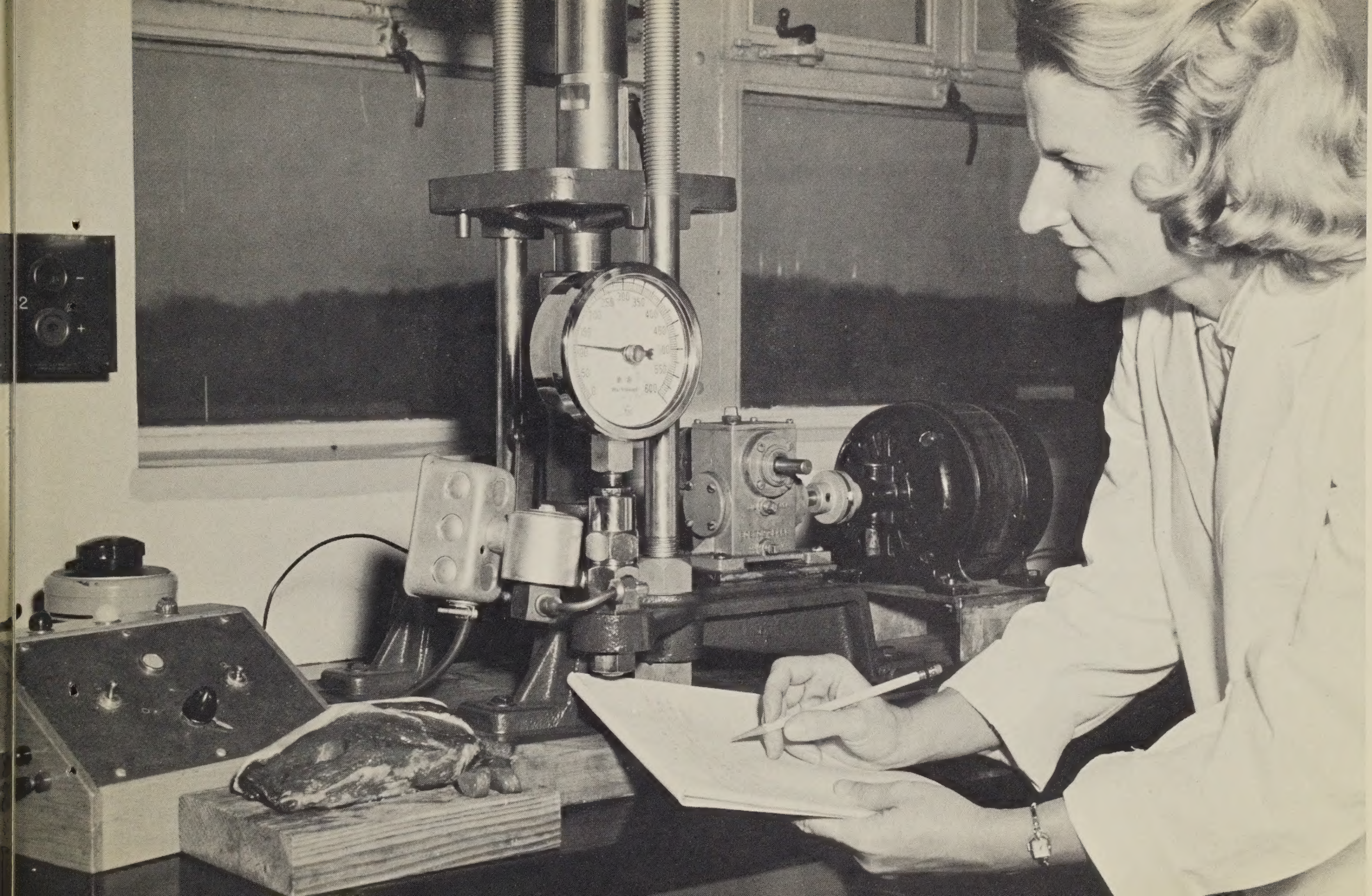

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AGRICULTURE 2000

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